

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant : Richard E. Smalley, et al.                      Art Unit : 1754  
Serial No. : 10/033,028                                      Examiner : Stuart L. Hendrickson  
Filed : December 28, 2001                                      Conf. No. : 1029  
Title : COMPOSITIONS AND ARTICLES OF MANUFACTURE

**Mail Stop Appeal Brief - Patents**

Commissioner for Patents  
P.O. Box 1450  
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**AMENDED BRIEF ON APPEAL**

This Amended Appeal Brief is submitted pursuant to the Notification of Non-Compliant Appeal Brief dated December 14, 2007, which Appeal Brief was submitted pursuant to the Notice of Appeal filed in the U.S. Patent and Trademark Office on September 28, 2007, and in support of the appeal from the Final Rejection set forth in the Office Action mailed on March 28, 2007. The fee for filing a brief in support of an appeal was previously paid.

**I. REAL PARTY-IN-INTEREST**

The real party-in-interest is William Marsh Rice University, the assignee of the entire right and interest in the present Application.

**II. RELATED APPEALS AND INTERFERENCES**

There are no appeals or interferences known to Appellant, the Appellant's legal representative, or assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**III. STATUS OF CLAIMS**

Claims 164, 166, 170-174 and 196-229 are pending in the Application.

Claims 164, 166, 170-174 and 196-229 are rejected.

Claims 164, 166, 170-174 and 196-229 are being appealed.

Claims 1-163, 167-169, 175-195 were previously cancelled.

#### **IV. STATUS OF AMENDMENTS**

There were no amendments to the claims or Specification filed after the Final Rejection.

#### **V. SUMMARY OF THE CLAIMED SUBJECT MATTER**

These claims relate to compositions and articles of manufacturing comprising single-wall carbon nanotubes (SWNTs). A brief explanation of single-wall carbon nanotubes is given in the Application, at page 8, *l.* 13 through page 10, *l.* 26.

Carbon nanotubes, and in particular the single-wall carbon nanotubes of this invention, are useful for making electrical connectors in micro devices such as integrated circuits or in semiconductor chips used in computers because of the electrical conductivity and small size of the carbon nanotube. Application, at page 8, *l.* 13 through page 9, *l.* 1. The carbon nanotubes are useful as antennas at optical frequencies, and as probes for scanning probe microscopy such as are used in scanning tunneling microscopes (STM) and atomic force microscopes (AFM). *Id.*, at page 9, *ll.* 1-4. The tubular carbon molecules of this invention may also be used in RF shielding applications, *e.g.*, to make microwave absorbing materials. *Id.*, at page 30, *ll.* 9-10.

According to one of the independent claims, Claim 164, a quantum device in the claimed invention comprises a plurality of conductors, wherein the conductors of the quantum device comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes of the conductors have a substantially similar length. The quantum device is described in the Application, at page 25, *ll.* 18-25.

According to another of the independent claims, Claim 166, an integrated circuit comprises a plurality of molecular wires, wherein the molecular wires of the integrated circuit comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes have a substantially similar length. The integrated circuit is described in the Application, at page 8, *l.* 28 through page 9, *l.* 1, at page 25, *ll.* 18-25, at page 29, *l.* 25 through page 30, *l.* 4, and at page 61, *ll.* 5-11.

According to another of the independent claims, Claim 170, an RF shielding device comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the RF shielding device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length. The RF shielding device is described

in the Application, at page 30, *ll.* 9-10.

According to another of the independent claims, Claim 171, a microwave absorbing material comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the microwave absorbing material have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length. The microwave absorbing material is described in the Application, at page 30, *ll.* 9-10.

According to another of the independent claims, Claim 172, a hydrogen storage device comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length. The hydrogen storage device is described in the Application, at page 30, *ll.* 9-10, and at page 48, *ll.* 3-7.

According to another of the independent claims, Claim 173, a battery comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length. The battery is described in the Application, at page 30, *ll.* 9-10, at page 35, *l.* 29 through page 36, *l.* 4, at page 48, *ll.* 3-7, at page 52, *l.* 18 through page 56, *l.* 11, and in Figures 13 and 14.

According to another of the independent claims, Claim 174, a fuel cell comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar. The fuel cell is described in the Application, at page 30, *ll.* 9-10, and at page 48, *l.* 3-7.

According to another of the independent claims, Claim 196, a hydrogen storage device comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable to store hydrogen that is stored in the hydrogen storage device. The hydrogen storage device is described in the Application, at page 30, *ll.* 9-10, and at page 48, *ll.* 3-7.

According to another of the independent claims, Claim 197, a battery comprises a

plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable as a hydrogen storage device within the battery. The battery is described in the Application, at page 30, *ll.* 9-10, at page 35, *l.* 29 through page 36, *l.* 4, at page 48, *ll.* 3-7, at page 52, *l.* 18 through page 56, *l.* 11, and in Figures 13 and 14.

According to another of the independent claims, Claim 198, a fuel cell comprises a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable to store hydrogen in the fuel cell. The fuel cell is described in the Application, at page 30, *l.* 9-10, and at page 48, *l.* 3-7.

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

A. Claims 164, 166, 170-174 and 199-220 stand rejected under 35 U.S.C. § 102(a) and (b) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over Kiang *et al.* "Structural Modification of Single-Layer Carbon Nanotubes with an Electron Beam," *J. Phys. Chem.* **1996**, 100, 3749-3752, ("*Kiang*").

B. Claims 170-174, 196-198 and 206-229 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Kiang*.

## **VII. ARGUMENTS**

### **A. 35 U.S.C. § 102(a) and (b) / § 103(a) Rejections Over *Kiang***

Examiner has rejected Claims 164, 166, 170-174 and 199-220 under 35 U.S.C. § 102(a) and (b) as being anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as obvious over *Kiang*. Examiner has contended the "[*Kiang*] reference teaches on pg. 3750 cut nanotubes. SWNTs are depicted, however, the discussion is general. In so far as claim 173, 174 require anything beyond nanotubes, then using SWNTs in a battery/fuel cell is an obvious expedient to exploit their electrical properties." Final Office Action of January 11, 2005, ("Final Office Action of January 2005"), at 2; *see also* Office Action of October 17, 2006 ("Office Action of

October 2006"), at 2, and Final Office Action of March 28, 2007 ("Final Office Action of March 2007"), at 2.

Applicant traverses these rejections.

Regarding rejections under 35 U.S.C. § 102(a) and (b), anticipation requires each and every element of the claim to be found within the cited prior art reference. Regarding rejections under 35 U.S.C. § 103(a), the prior art reference must teach or suggest all the claim limitations. Such teaching or suggestion to make the claimed combination must both be found in the prior art and not based on applicant's disclosure. *See* M.P.E.P. 706.02(j); *see also In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). Failing the above, a *prima facie* case of obviousness is not established. *Id.*

#### 1. Claim 164

Claims 164 recites:

A quantum device comprising a plurality of conductors, wherein the conductors of the quantum device comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes of the conductors have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose a quantum device comprising a plurality of conductors. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 164, *Kiang* does not further teach, disclose, or suggest that the conductors of the quantum device comprise cut single-wall carbon nanotubes. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, support in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length includes:

In another embodiment, a method for producing tubular carbon molecules of about 5 to 500 nm in length is also disclosed. The method includes the steps of cutting single-wall nanotube containing-material to form a mixture of tubular carbon molecules having lengths in the range of 5-500 nm and *isolating a fraction of the molecules having substantially equal lengths*. The nanotubes disclosed may be used, singularly or in multiples, in power transmission cables, in solar cells, in batteries, as antennas, as molecular electronics, as probes and

manipulators, and in composites.

Application, at page 4, *ll.* 1-8 (emphasis added).

Alternatively, bucky paper may be made up of *nanotubes which are homogeneous in length* or diameter and/or molecular structure due to fractionation as described hereinafter.

Application, at page 23, *ll.* 19-21 (emphasis added).

Preparation of *homogeneous populations of short carbon nanotube molecules may be accomplished by cutting and annealing (reclosing) the nanotube pieces followed by fractionation.* The cutting and annealing processes may be carried out on a purified nanotube bucky paper, on felts prior to purification of nanotubes or on any material that contains single-wall nanotubes. When the cutting and annealing process is performed on felts, it is preferably followed by oxidative purification, and optionally saponification, to remove amorphous carbon. Preferably, the starting material for the cutting process is purified single-wall nanotubes, substantially free of other material.

The short nanotube pieces can be cut to a length or selected from a range of lengths, that facilitates their intended use. For applications involving the individual tubular molecules per se (*e.g.*, derivatives, nanoscale conductors in quantum devices, *i.e.*, molecular wire), the length can be from just greater than the diameter of the tube up to about 1,000 times the diameter of the tube. Typical tubular molecules will be in the range of from about 5 to 1,000 nanometers or longer. For making template arrays useful in growing carbon fibers of SWNT as described below, lengths of from about 50 to 500 nm are preferred.

Any method of cutting that achieves the desired length of nanotube molecules without substantially affecting the structure of the remaining pieces can be employed. The preferred cutting method employs irradiation with high mass ions. In this method, a sample is subjected to a fast ion beam, *e.g.*, from a cyclotron, at energies of from about 0.1 to 10 giga-electron volts. Suitable high mass ions include those over about 150 AMU's such as bismuth, gold, uranium and the like.

*Preferably, populations of individual single-wall nanotube molecules having homogeneous length are prepared starting with a heterogeneous bucky paper and cutting the nanotubes in the paper using a gold ( $Au^{+33}$ ) fast ion beam.*

Application, at page 25, *l.* 9 to page 26, *l.* 5 (emphasis added).

#### **Example 5. Procedure for cutting SWNT into tubular carbon molecules**

Bucky paper (-100 microns thick) obtained by the filtration and baking of purified SWNT material as described in Example 1 was exposed to a 2 GEV beam of  $Au^{+33}$  ions in the Texas A&M Superconducting Cyclotron Facility for 100 minutes. The irradiated paper had 10-100 nm bullet holes on average every

100 nm along the nanotube lengths. The irradiated paper was refluxed in 2.6 M nitric acid for 24 hours to etch away the amorphous carbon produced by the fast ion irradiation, filtered, sonicated in ethanol/potassium hydroxide for 12 hours, refiltered, and then baked in vacuum at 1100°C to seal off the ends of the cut nanotubes.

The material was then dispersed in toluene while sonicating. The resulting tubular molecules which averaged about 50-60 nm in length were examined via SEM and TEM.

Application, at page 8, *ll.* 8-20 (bolding in the original).

In another embodiment, a method for continuously growing a macroscopic carbon fiber comprising at least about  $10^6$  single-wall nanotubes in generally parallel orientation is disclosed. In this method, a macroscopic molecular array of at least about  $10^6$  tubular carbon molecules in generally parallel orientation and having substantially *similar lengths* in the range of from about 50 to about 500 nanometers is provided.

Application, at page 5, *ll.* 1-6, (emphasis added).

In another embodiment, a macroscopic molecular array comprising at least about  $10^6$  single-wall carbon nanotubes in generally parallel orientation and *having substantially similar lengths* in the range of from about 5 to about 500 nanometers is disclosed.

Application, at page 5, *ll.* 13-16 (emphasis added).

In another embodiment, a method for forming a macroscopic molecular array of tubular carbon molecules is disclosed. This method includes the steps of providing at least about  $10^6$  *tubular carbon molecules of substantially similar length in the range of 50 to 500 nm*; introducing a linking moiety onto at least one end of the tubular carbon molecules; providing a substrate coated with a material to which the linking moiety will attach; and contacting the tubular carbon molecules containing a linking moiety with the substrate.

Application at page 4, *ll.* 9-15 (emphasis added).

On the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.<sup>1</sup>

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<sup>1</sup> Examiner also contended "*Kiang* teaches a homogeneous product." Final Office Action of March 2007, at 2. Applicant respectfully disagrees. As noted, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, as noted above, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that the lengths would be a substantially similar length.

Furthermore and as noted above, Claim 164 is drawn to a quantum device. As such, *Kiang* does not teach, disclose, or suggest “[a] quantum device comprising a plurality of conductors, wherein the conductors of the quantum device comprise cut single-wall carbon nanotubes” as required by Claim 164.<sup>2</sup>

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 164; and, therefore, Claim 164 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 164 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 164 is neither anticipated nor *prima facie* obvious over *Kiang*.

## **2. Claim 199**

Regarding Claim 199, this claim is dependent upon Claim 164. Thus, Claim 199 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.1.

Furthermore, Claim 199 requires, *inter alia*, that the cut single-wall carbon nanotubes have a substantially similar length and diameter, and that “the substantially similar length is between the substantially similar diameter and 1000 times the substantially similar diameter.” *Kiang* also does not disclose, teach or suggest these additional limitations of Claim 199.

Furthermore, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required

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<sup>2</sup> Examiner further contended that “There is no reason as to why the nanotube mix of *Kiang* would not act as a battery/conductor etc. if the appropriate leads, etc. were hooked to them.” Final Office Action of March 2007, at 2. Applicant notes that this contention ignores the elements of the claims of the instant invention, which requires cut single-wall carbon nanotubes having a substantially similar length. Moreover, the statement distorts the anticipation and obviousness analysis. Whether or not the carbon nanotubes in *Kiang* could have, in hindsight, acted as battery/conductor when hooked up, is not the standard for anticipation or obviousness.



features of the instant invention.

Accordingly, Claim 199 is neither anticipated nor *prima facie* obvious over *Kiang*.

### **3. Claim 200**

Regarding Claim 200, this claim is also dependant upon Claim 164. Thus, Claim 200 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.1.

Furthermore, Claim 200 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 200.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 200 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **4. Claim 201**

Regarding Claim 201, this claim is also dependant upon Claim 164. Thus, Claim 201 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.1.

Furthermore, Claim 201 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 201.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 201 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **5. Claim 202**

Regarding Claim 202, this claim is also dependant upon Claim 164. Thus, Claim 202 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.1.

Furthermore, Claim 202 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm.

*Kiang* also does not teach or suggest this additional limitation of Claim 202.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 202 is further neither anticipated nor *prima facie* obvious over *Kiang*.

## 6. Claim 166

Claims 166 recites:

An integrated circuit comprising a plurality of molecular wires, wherein the molecular wires of the integrated circuit comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose an integrated circuit comprising molecular wires. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 166, *Kiang* does not further teach, disclose, or suggest that the molecular wires of the integrated circuit comprise cut single-wall carbon nanotubes. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 166 is directed to an integrated circuit. As such, *Kiang* does not teach, disclose or suggest “[a]n integrated circuit comprising a plurality of molecular wires, wherein the molecular wires of the integrated circuit comprise cut single-wall carbon nanotubes,” as required by Claim 166.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 166; and, therefore, Claim 166 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 166 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 166 is neither anticipated nor *prima facie* obvious over *Kiang*.

**7. Claim 203**

Regarding Claim 203, this claim is dependant upon Claim 166. Thus, Claim 203 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.6.

Furthermore, Claim 203 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 203.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 203 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**8. Claim 204**

Regarding Claim 204, this claim is also dependant upon Claim 166. Thus, Claim 204 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.6.

Furthermore, Claim 204 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 204.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 204 is further neither

anticipated nor *prima facie* obvious over *Kiang*.

#### **9. Claim 205**

Regarding Claim 205, this claim is also dependant upon Claim 166. Thus, Claim 205 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.6.

Furthermore, Claim 205 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 205.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 205 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **10. Claim 170**

Claims 170 recites:

An RF shielding device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the RF shielding device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose an RF shielding device comprising a plurality of single-wall carbon nanotubes. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 170, *Kiang* does not further teach, disclose, or suggest that the single-wall carbon nanotubes of the RF shielding device have been purified and cut. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the purified and cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does

*Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 170 is directed to an RF shielding device. As such, *Kiang* does not teach, disclose or suggest “[a]n RF shielding device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the RF shielding device have been purified and cut,” as required by Claim 170.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 170; and, therefore, Claim 170 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 170 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 170 is neither anticipated nor *prima facie* obvious over *Kiang*.

#### **11. Claim 206**

Regarding Claim 206, this claim is dependant upon Claim 170. Thus, Claim 206 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.10.

Furthermore, Claim 206 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 206.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 206 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **12. Claim 207**

Regarding Claim 207, this claim is also dependant upon Claim 170. Thus, Claim 207 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in

Section VII.A.10.

Furthermore, Claim 207 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 207.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 207 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**13. Claim 208**

Regarding Claim 208, this claim is also dependant upon Claim 170. Thus, Claim 208 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.10.

Furthermore, Claim 208 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 208.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 208 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**14. Claim 171**

Claims 171 recites:

A microwave absorbing material comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the microwave absorbing material have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose a microwave absorbing device comprising a plurality of single-wall carbon nanotubes. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 171, *Kiang* does not further teach, disclose, or suggest that the single-wall carbon nanotubes of the microwave absorbing device have been purified and cut. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or

suggest that the purified and cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 171 is directed to a microwave device. As such, *Kiang* does not teach, disclose or suggest “[a] microwave absorbing material comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the microwave absorbing material have been purified and cut,” as required by Claim 171.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 171; and, therefore, Claim 171 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 171 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*). Accordingly, Claim 171 is neither anticipated nor *prima facie* obvious over *Kiang*.

#### **15. Claim 209**

Regarding Claim 209, this claim is dependant upon Claim 171. Thus, Claim 209 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.14.

Furthermore, Claim 209 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 209.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 209 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**16. Claim 210**

Regarding Claim 210, this claim is also dependant upon Claim 171. Thus, Claim 210 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.14.

Furthermore, Claim 210 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 210.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 210 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**17. Claim 211**

Regarding Claim 211, this claim is also dependant upon Claim 171. Thus, Claim 211 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.14.

Furthermore, Claim 211 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 211.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 211 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**18. Claim 172**

Claims 172 recites:

A hydrogen storage device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage



device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose a hydrogen storing device comprising a plurality of single-wall carbon nanotubes. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 172, *Kiang* does not further teach, disclose, or suggest that the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the purified and cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 172 is directed to a hydrogen storage device. As such, *Kiang* does not teach, disclose or suggest “[a] hydrogen storage device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut,” as required by Claim 172.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 172; and, therefore, Claim 172 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 172 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 172 is neither anticipated nor *prima facie* obvious over *Kiang*.

**19. Claim 212**

Regarding Claim 212, this claim is dependant upon Claim 172. Thus, Claim 212 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.18.

Furthermore, Claim 212 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 212.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 212 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**20. Claim 213**

Regarding Claim 213, this claim is also dependant upon Claim 172. Thus, Claim 213 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.18.

Furthermore, Claim 213 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 213.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 213 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**21. Claim 214**

Regarding Claim 214, this claim is also dependant upon Claim 172. Thus, Claim 214 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.18.

Furthermore, Claim 214 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 214.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 214 is further neither anticipated nor *prima facie* obvious over *Kiang*.

## 22. Claim 173

Claims 173 recites:

A battery comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose a battery comprising a plurality of single-wall carbon nanotubes. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 173, *Kiang* does not further teach, disclose, or suggest that the single-wall carbon nanotubes of the battery have been purified and cut. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the purified and cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 173 is directed to a battery. As such, *Kiang* does not teach, disclose or suggest “[a] battery comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut,” as required by Claim 173.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 173; and, therefore, Claim 173 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of

Claim 173 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Also, as noted above in the Final Office Action, Examiner contended “[i]n so far as claims 173, 174 require anything beyond nanotubes, then using SWNTs in a battery/fuel cell is an obvious expedient to exploit their electrical properties.” Final Office Action of January 2005, at 2; Office Action of October 2006, at 2; and Final Office Action of March 2007, at 2. Applicant again reiterates that all of the claims (including, but not limited to, Claim 173) require more than just cut single-wall carbon nanotubes, which Applicant has pointed out consistently during the prosecution of this Application. As for Claim 173, and as pointed out above, this claim does require additional features, including that the cut single-wall carbon nanotubes are included in a battery, and that the cut single-wall carbon nanotubes have a substantially similar length.

Accordingly, Claim 173 is neither anticipated nor *prima facie* obvious over *Kiang*.

### **23. Claim 215**

Regarding Claim 215, this claim is dependant upon Claim 173. Thus, Claim 215 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.22.

Furthermore, Claim 215 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 215.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 215 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **24. Claim 216**

Regarding Claim 216, this claim is also dependant upon Claim 173. Thus, Claim 216 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.22.

Furthermore, Claim 216 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 216.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 216 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **25. Claim 217**

Regarding Claim 217, this claim is also dependant upon Claim 173. Thus, Claim 217 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.22.

Furthermore, Claim 217 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 217.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 217 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **26. Claim 174**

Claims 174 recites:

A fuel cell comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar.

*Kiang* does not teach, disclose, or suggest particular features of the claimed invention. For instance, *Kiang* does not disclose a fuel cell comprising a plurality of single-wall carbon nanotubes. Furthermore, even if *Kiang* somehow taught, disclosed, or suggested that feature of Claim 174, *Kiang* does not further teach, disclose, or suggest that the single-wall carbon

nanotubes of the fuel cell have been purified and cut. Additionally, even if *Kiang* somehow taught both of those features, *Kiang* does not further teach, disclose, or suggest that the purified and cut single-wall carbon nanotubes have a substantially similar length.

As for the last of these absent features, as reflected above in Section VII.A.1., support is present in the Specification directed to the uniformity of cutting single-wall carbon nanotubes to have a substantially similar length. And, again, on the other hand, there is no teaching or suggestion in *Kiang* that the cut single-wall carbon nanotubes of *Kiang* have a substantially similar length. To the contrary, *Kiang* discloses cutting nanotubes with no suggestion or motivation to cut them so that their resulting lengths would be substantially similar. Nor, does *Kiang* disclose, teach, or suggest, a process to do so.

Furthermore, and as noted above, Claim 174 is directed to a fuel cell. As such, *Kiang* does not teach, disclose or suggest “[a] fuel cell comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut,” as required by Claim 174.

Thus, *Kiang* does not teach, disclose, or suggest all the limitations of Claim 174; and, therefore, Claim 174 is not anticipated by *Kiang*.

Furthermore, that *Kiang* does not teach, disclose, or suggest all of the limitations of Claim 174 alone reflects that no *prima facie* case of obviousness was established. A *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Also, as noted above in the Final Office Action, Examiner contended “[i]n so far as claims 173, 174 require anything beyond nanotubes, then using SWNTs in a battery/fuel cell is an obvious expedient to exploit their electrical properties.” Final Office Action of January 2005, at 2; Office Action of October 2006, at 2; and Final Office Action of March 2007, at 2. Applicant again reiterates that all of the claims (including, but not limited to, Claim 174) require more than just cut single-wall carbon nanotubes, which Applicant has pointed out consistently

during the prosecution of this Application. As for Claim 174, and as pointed out above, this claim does require additional features, including that the cut single-wall carbon nanotubes are included in a fuel cell, and that the cut single-wall carbon nanotubes have a substantially similar length.

Accordingly, Claim 174 is neither anticipated nor *prima facie* obvious over *Kiang*.

**27. Claim 218**

Regarding Claim 218, this claim is dependant upon Claim 174. Thus, Claim 218 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.26.

Furthermore, Claim 218 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 218.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 218 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**28. Claim 219**

Regarding Claim 219, this claim is also dependant upon Claim 174. Thus, Claim 219 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.26.

Furthermore, Claim 219 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 219.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 219 is further neither anticipated nor *prima facie* obvious over *Kiang*.

**29. Claim 220**

Regarding Claim 220, this claim is also dependant upon Claim 174. Thus, Claim 220 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in

Section VII.A.26.

Furthermore, Claim 220 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 220.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 220 is further neither anticipated nor *prima facie* obvious over *Kiang*.

Therefore, in light of all of the foregoing and because anticipation and a *prima facie* case of obviousness have not been established for Claims 164, 166, 170-174 and 199-220, these Claims cannot be held anticipated under 35 U.S.C. § 102(a) or 102(b) or obvious under 35 U.S.C. § 103(a).

**B. 35 U.S.C. § 103(a) Rejections Over *Kiang***

Examiner has rejected Claims 170-174, 196-198 and 206-229 under 35 U.S.C. § 103(a) as being unpatentable over *Kiang et al.* Final Office Action of March 2007, at 2.

Examiner contends that the “reference, supra, does not teach a battery/fuel cell/device, however using the nanotubes in these devices is an obvious expedient to exploit their well-characterized properties alluded to in col. 1. “ *Id.*

Applicant respectfully traverses the rejection.

**1. Claims 170-174 and 206-220**

Regarding Claims 170-174 and 206-220, Applicant has addressed these same obviousness rejections in its discussions directed to each of these claims in Sections VII.A.10-29 (for Claims 170, 206-208, 171, 209-211, 172, 212-214, 173, 215-217, 174, and 218-220, respectively). For the same reasons discussed above in each of these sections for its respective claim, that claim is not *prima facie* obvious over *Kiang*.

**2. Claim 196**

Claims 196 recites:

A hydrogen storage device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon



nanotubes are operable to store hydrogen that is stored in the hydrogen storage device.

Claim 196 includes all of the elements of Claim 172, plus the additional limitation, "wherein the single-wall carbon nanotubes are operable to store hydrogen that is stored in the hydrogen storage device." Thus, Claim 196 is not *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.18.

Furthermore, *Kiang* also does not teach, disclose, or suggest the limitation "wherein the single-wall carbon nanotubes are operable to store hydrogen that is stored in the hydrogen storage device." Again, a *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 196 is not *prima facie* obvious over *Kiang*.

### **3. Claim 221**

Regarding Claim 221, this claim is dependant upon Claim 196. Thus, Claim 221 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.2.

Furthermore, Claim 221 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 221.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 221 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **4. Claim 222**

Regarding Claim 222, this claim is also dependant upon Claim 196. Thus, Claim 222 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.2.

Furthermore, Claim 222 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 222.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 222 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **5. Claim 223**

Regarding Claim 223, this claim is also dependant upon Claim 196. Thus, Claim 223 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.2.

Furthermore, Claim 223 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 223.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 223 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **6. Claim 197**

Claims 197 recites:

A battery comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable as a hydrogen storage device within the battery.

Claim 197 includes all of the elements of Claim 173, plus the additional limitation, "wherein the single-wall carbon nanotubes are operable as a hydrogen storage device within the battery." Thus, Claim 197 is not *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.22.

Furthermore, *Kiang* also does not teach, disclose, or suggest the limitation "wherein the single-wall carbon nanotubes are operable as a hydrogen storage device within the battery."

Again, a *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 197 is not *prima facie* obvious over *Kiang*.

#### **7. Claim 224**

Regarding Claim 224, this claim is dependant upon Claim 197. Thus, Claim 224 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.6.

Furthermore, Claim 224 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 224.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 221 is further neither anticipated nor *prima facie* obvious over *Kiang*.

#### **8. Claim 225**

Regarding Claim 225, this claim is also dependant upon Claim 197. Thus, Claim 225 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.6.

Furthermore, Claim 225 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 225.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 225 is further neither anticipated nor *prima facie* obvious over *Kiang*.

## 9. Claim 226

Regarding Claim 226, this claim is also dependant upon Claim 197. Thus, Claim 226 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.6.

Furthermore, Claim 226 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 226.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 226 is further neither anticipated nor *prima facie* obvious over *Kiang*.

## 10. Claim 198

Claims 198 recites:

A fuel cell comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable to store hydrogen in the fuel cell.

Claim 198 includes all of the elements of Claim 174, plus the additional limitation, "wherein the single-wall carbon nanotubes are operable to store hydrogen in the fuel cell." Thus, Claim 198 is not *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.A.26.

Furthermore, *Kiang* also does not teach, disclose, or suggest the limitation "wherein the single-wall carbon nanotubes are operable to store hydrogen in the fuel cell." Again, a *prima facie* case of obviousness can only be made when the prior art reference (here *Kiang*) teaches or suggests all the claim limitations. M.P.E.P. § 706.02(j). Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention (*i.e.*, there is no suggestion or motivation in *Kiang* to somehow add in the features discussed above that are absent in *Kiang*).

Accordingly, Claim 198 is not *prima facie* obvious over *Kiang*.

### **11. Claim 227**

Regarding Claim 227, this claim is dependant upon Claim 198. Thus, Claim 227 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.10.

Furthermore, Claim 227 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 1000 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 227.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 227 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **12. Claim 228**

Regarding Claim 228, this claim is also dependant upon Claim 198. Thus, Claim 228 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.10.

Furthermore, Claim 228 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 5 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 228.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 228 is further neither anticipated nor *prima facie* obvious over *Kiang*.

### **13. Claim 229**

Regarding Claim 229, this claim is also dependant upon Claim 198. Thus, Claim 229 is neither anticipated nor *prima facie* obvious over *Kiang*, for the same reasons as expressed in Section VII.B.10.

Furthermore, Claim 229 requires that the cut single-wall carbon nanotubes have a substantially similar length in a particular range, namely in the range of about 50 to 500 nm. *Kiang* also does not teach or suggest this additional limitation of Claim 229.

Moreover, there is no suggestion or motivation in *Kiang* or in the knowledge generally

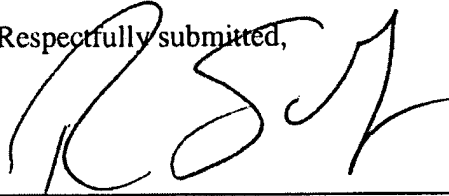
available to one of ordinary skill in the art, to modify *Kiang* in order to arrive at these required features of the instant invention. Thus, for this additional reason, Claim 229 is further neither anticipated nor *prima facie* obvious over *Kiang*.

Therefore, in light of all of the foregoing and because a *prima facie* case of obviousness has not been established for Claims 170-174, 196-198 and 206-229, these Claims cannot be held obvious under 35 U.S.C. § 103(a).

For these reasons, and the reasons stated in the Appeal Brief, Applicant submits that the final rejection should be reversed.

The fees are being paid concurrently herewith on the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply all charges or credits to Deposit Account No. 06-1050, referencing Attorney Docket No. 21753-012014.

Respectfully submitted,



Date: January 11, 2008

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## CLAIMS APPENDIX

164. A quantum device comprising a plurality of conductors, wherein the conductors of the quantum device comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes of the conductors have a substantially similar length.
166. An integrated circuit comprising a plurality of molecular wires, wherein the molecular wires of the integrated circuit comprise cut single-wall carbon nanotubes, wherein the cut single-wall carbon nanotubes have a substantially similar length.
170. An RF shielding device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the RF shielding device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.
171. A microwave absorbing material comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the microwave absorbing material have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.
172. A hydrogen storage device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.
173. A battery comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar length.

174. A fuel cell comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, and wherein the purified and cut single-wall carbon nanotubes have a substantially similar.
196. A hydrogen storage device comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the hydrogen storage device have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable to store hydrogen that is stored in the hydrogen storage device.
197. A battery comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the battery have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable as a hydrogen storage device within the battery.
198. A fuel cell comprising a plurality of single-wall carbon nanotubes, wherein the single-wall carbon nanotubes of the fuel cell have been purified and cut, wherein the purified and cut single-wall carbon nanotubes have a substantially similar length, and wherein the single-wall carbon nanotubes are operable to store hydrogen in the fuel cell.
199. The quantum device of Claim 164 wherein (i) the cut single-wall carbon nanotubes of the conductors have a substantially similar diameter, (ii) the cut single-wall carbon nanotubes have a substantially similar length, and (iii) the substantially similar length is between the substantially similar diameter and 1000 times the substantially similar diameter.
200. The quantum device of Claim 164, wherein the substantially similar length is in the range of about 5 to 1000 nm.
201. The quantum device of Claim 164, wherein the substantially similar length is in the range of about 5 to 500 nm.



202. The quantum device of Claim 164, wherein the substantially homogenous length is in the range of about 50 to 500 nm.
203. The integrated circuit of Claim 166, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
204. The integrated circuit of Claim 166, wherein the substantially similar length is in the range of about 5 to 500 nm.
205. The integrated circuit of Claim 166, wherein the substantially similar length is in range of about 50 to 500 nm.
206. The RF shielding device of Claim 170, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
207. The RF shielding device of Claim 170, wherein the substantially similar length is in the range of about 5 to 500 nm.
208. The RF shielding device of Claim 170, wherein the substantially similar length is in the range of about 50 to 500 nm.
209. The microwave absorbing material of Claim 171, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
210. The microwave absorbing material of Claim 171, wherein the substantially similar length is in the range of about 5 to 500 nm.
211. The microwave absorbing material of Claim 171, wherein the substantially similar length is in the range of about 50 to 500 nm.
212. The hydrogen storage device of Claim 172, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.

213. The hydrogen storage device of Claim 172, wherein the substantially similar length is in the range of about 5 to 500 nm.
214. The hydrogen storage device of Claim 172, wherein the substantially similar length is in the range of about 50 to 500 nm.
215. The battery of Claim 173, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
216. The battery of Claim 173, wherein the substantially similar length is in the range of about 5 to 500 nm.
217. The battery of Claim 173, wherein the substantially similar length is in the range of about 50 to 500 nm.
218. The fuel cell of Claim 174, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
219. The fuel cell of Claim 174, wherein the substantially similar length is in the range of about 5 to 500 nm.
220. The fuel cell of Claim 174, wherein the substantially similar length is in the range of about 50 to 500 nm.
221. The hydrogen storage device of Claim 196, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
222. The hydrogen storage device of Claim 196, wherein the substantially similar length is in the range of about 5 to 500 nm.
223. The hydrogen storage device of Claim 196, wherein the substantially similar length is in the range of about 50 to 500 nm.

- 224. The battery of Claim 197, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
- 225. The battery of Claim 197, wherein the substantially similar length is in the range of about 5 to 500 nm.
- 226. The battery of Claim 197, wherein the substantially similar length is in the range of about 50 to 500 nm.
- 227. The fuel cell of Claim 198, wherein the substantially similar length is in the range of about 5 nm to 1000 nm.
- 228. The fuel cell of Claim 198, wherein the substantially similar length is in the range of about 5 to 500 nm.
- 229. The fuel cell of Claim 198, wherein the substantially similar length is in the range of about 50 to 500 nm.

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### EVIDENCE APPENDIX

No other evidence was submitted pursuant to §§1.130, 1.131, or 1.132 of 37 C.F.R. or of any other evidence entered by the Examiner and relied upon by Appellants in the Appeal.

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RELATED PROCEEDINGS APPENDIX

There are no related proceedings to the current proceeding.

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